Study on Mechanical Properties of Concrete by using Robo Sand as a Partial Replacement of Fine Aggregate

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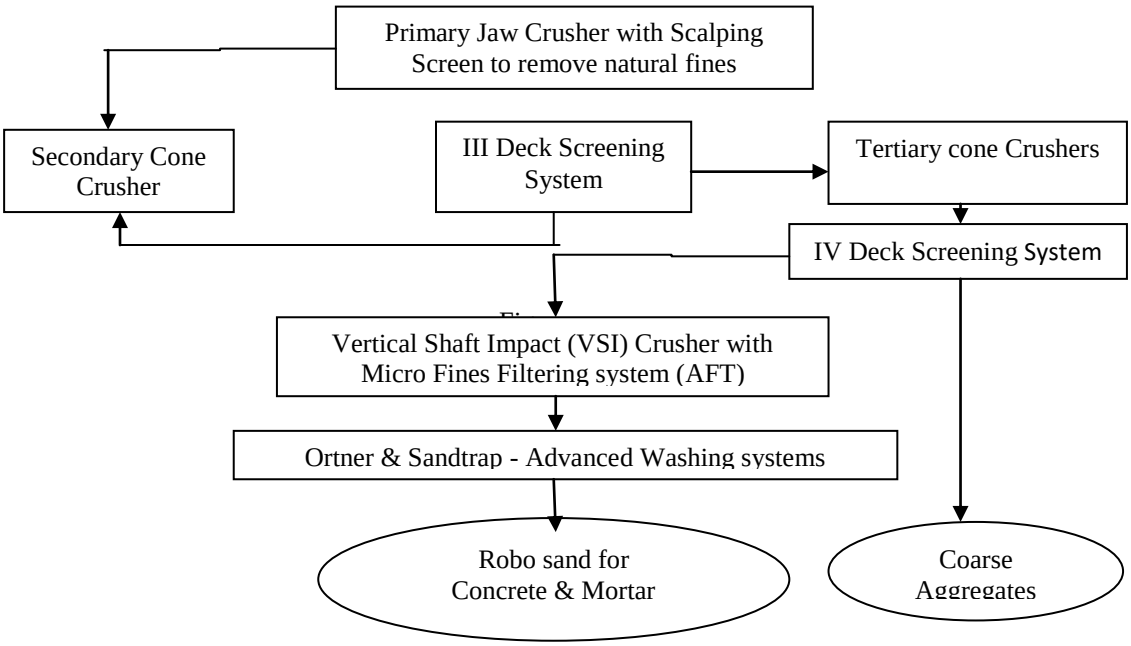
Abstract- Robo sand is one of the most used among such materials to replace river sand, which can be used as an alternative to fine aggregate in concrete. In the present investigation workability and strength of concrete was evaluated by replacement of natural sand by Robo sand in proportions of 0%, 50%, 75%, and 100% is studied for M25and M35grade concrete cubes, cylinders and prisms. Slump cone method is taken for finding workability. For strength parameters for each grade of concrete Cubes, Cylinder sand Prisms were casted and tested at the age of 7 and 28 days. In this present experimental study on concrete having grades of M25 and M35 are prepared by replacing natural sand by Robo sand. Concrete specimens were tested for evaluation of compressive strength and water absorption. The compressive strength of concrete specimens made with 50%replacementof River sand by Robo sand gives higher strength of 12% to 15% and with 100% replacement gives a higher strength of 3% to 4% as compare to reference mix. The split tensile strength of concrete specimens made with 50% replacement of river sand by Robo sand gives higher strength of 7%to 9% and with 100% replacement gives a higher strength of 3%to 4% as compare to reference mix. The flexural strength of concrete specimens made with 50% replacement of river sand by Robo sand gives higher strength of 20%to 22% and with 100% replacement gives a higher strength of 5%to 8% as compare to reference mix.

I. INTRODUCTION

With the world wide decline in the availability of construction sands along with the environmental pressure to reduce extraction of sand from rivers. In general, the demand of natural sand is quite high in developing countries to satisfy the rapid infrastructure growth, in this situation developing country like India facing shortage in good quality natural sand. Particularly in India, natural sand deposits are being depleted and causing serious threat to environment as well as society. Increasing extraction of natural sand from river beds causing many problems. Due to the effects ban on sand mining implemented by different states, and with the increasing demand for river sand for construction works, many civil engineers have expressed the need to promote use of Robo sand in the construction industry. Fine aggregate is essential component of concrete and cement mortar. So, need for clean sand in the construction from the point of view of durability of structures. As the demand for Natural River sand is surpassing the availability, has resulted in fast depletion of natural sand sources. Robo sand is the answer for this problem especially when some states have already banned the use of river sand for construction. As per reports, Robo sand is widely used all around the world and technicians of major projects around the world insist on the compulsory use of Robo sand because of its consistent gradation and zero impurity.

Methodology:



1: Methodology of the study.

Robosand is crushed aggregate produced from hard granite stone which is cubically shaped with grounded edges, washed and graded with consistency to be used as a substitute of river sand with size range 4.75mm-75μas natural sand.

Cube compressive strength test: According to IS 516-1959. The test set up for conducting cube compressive strength test is depicted. Compression test on the cubes is conducted on the 200T compression testing machine. The cube was placed in the compression testing machine and the load on the cube is applied at a constant rate up to the failure of the specimen and the ultimate load is noted. The cube compressive strength of the concrete mix is then computed.

Split Tensile Strength**:** According to IS 5816-1999. This test is conducted on 200T compression testing machine. The cylinders prepared for testing are 150mm in diameter and 300mm height. After noting the weight of the cylinder, diametrical lines are drawn on the two ends, such that they are in the same axial plane. Then the cylinders placed on the bottom compression plate of the testing machine aligned such that the lines marked on the ends of the specimen are vertical. Then the top compression plate is brought into contact at the top of the cylinder. The load is applied at uniform rate, until the cylinder fails and the load is recorded. From this load, the splitting tensile strength is calculated for each specimen.

Flexural Strength Test: According to IS 516-1959. The prism specimens of size 500x 100x 100 mm were used for the determination of the flexural strength. The bearing surface of the supporting and loading rollers were wiped clean and any other loose fine aggregate or other materials removed from the surface of the specimen where they are to make contact with the rollers. The specimen was then placed in the machine and two point loads was applied. Load was increased until the specimen failed and the load at failure was recorded and the flexural strength was determined.

Discussion and Results:

i). **Compressive strength**:

\a). Compressive Strength of M25 Grade Concrete with Specimen /Control sample.

Table 1: Compressive Strength of M25 Grade Concrete with Specimen control sample.

S.No	Test Period	Average Compressive strength of the concrete at different ages(N/mm^2)
1	7days	21.93
2	28days	31.59

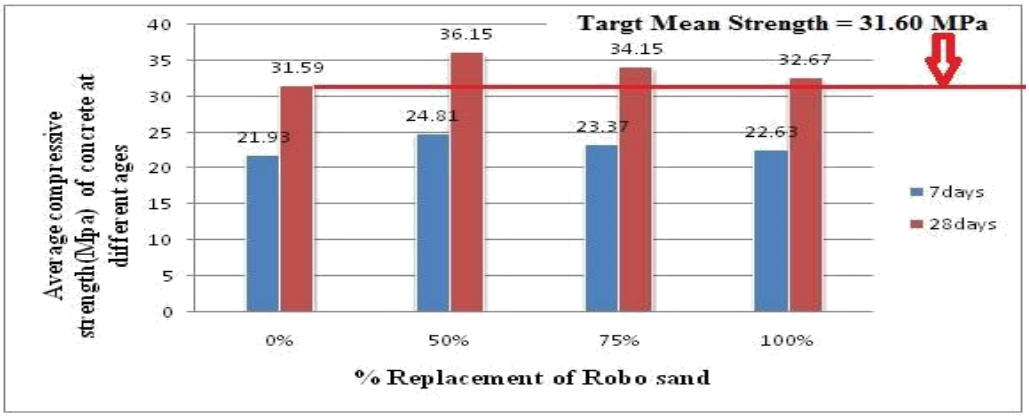


Table 2: Compressive Strength of M25 Grade Concrete With different proportions of Robosand.

S.No	Sand replacement	Average Compressive strength of the concrete at different ages(N/mm^2)	
		7days	28days
1	50%	24.81	36.15
2	75%	23.37	34.15
3	100%	22.63	32.67

Figure 2: The variation of 7 and 28 days compressive strength with increase in percentages of Robo sand for M25.

b). Compressive Strength of M35 Grade Concrete with Specimen /Control sample.

Table 3: Compressive Strength of M35 Grade Concrete with Specimen sample

S.No	**Test Period**	**Average Compressive strength of the concrete at different ages(N/mm^2)**
1	**7days**	28.93
2	**28days**	44.63

Table 4: Compressive Strength of M35 Grade Concrete With different proportions of Robo sand

S.No	**Sand replacement**	**Average Compressive strength of the concrete at different ages(N/mm^2)**	
		7days	**28days**
1	50%	31.52	49.33
2	75%	30.3	46.7
3	100%	29.07	45.15

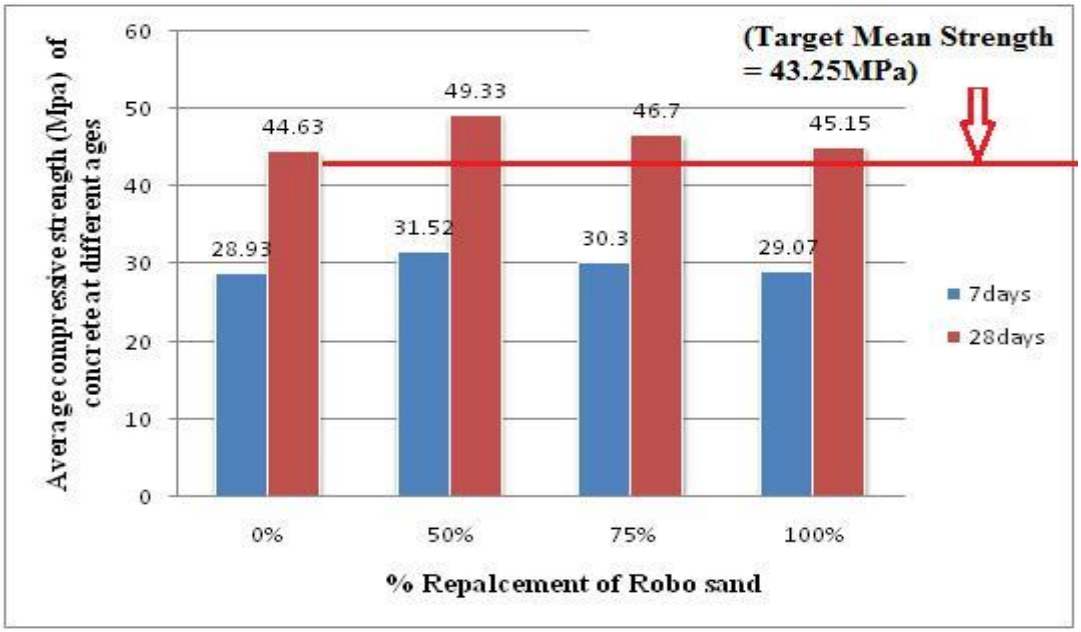


Figure3: Variation of 7 Days and 28 Days Compressive Strength of M35 Grade

ii). Split Tensile Strength:

a). Split Tensile Strength of M25 Grade Concrete with Specimen control sample

Table 5: Split Tensile Strength of M25 Grade Concrete with Specimen control sample

S.No	**Test Period**	**Average split tensile strength of the concrete at different ages(N/mm^2)**
1	7 days	2.62
2	28 days	2.71

Table 6: Split Tensile Strength of M25 Grade Concrete With different proportions of Robosand

S.No	**Sand replacement**	**Average split tensile strength of the concrete at different ages(N/mm^2)**	
		7days	**28days**
1	50%	2.76	4.03
2	75%	2.71	3.89
3	100%	2.67	3.85

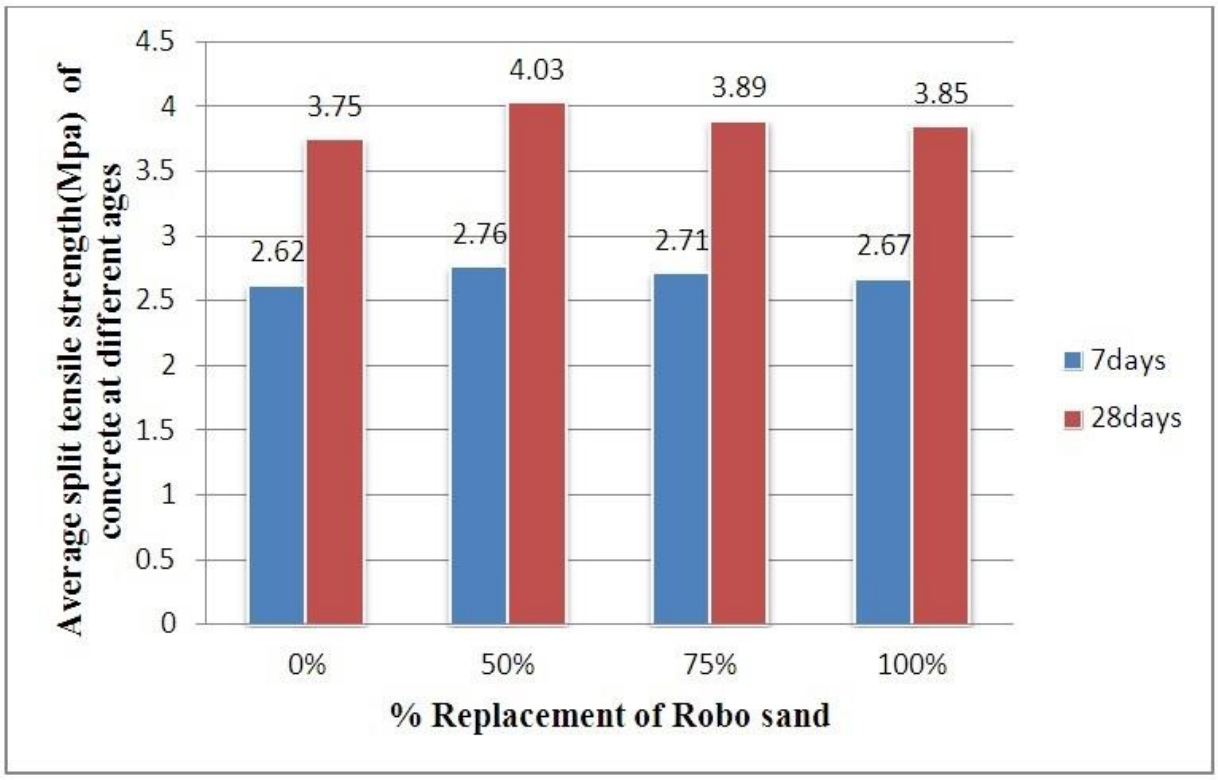


Figure 4: Variation of 7days and 28 Days Split Tensile Strength of M25 Grade

b). Split Tensile Strength of M35 Grade Concrete.
Table 7; Split Tensile Strength of M35 Grade Concrete with Specimen sample

S.No	**Test Period**	**Average split tensile strength of the concrete at different ages(N/mm^2)**
1	7 days	3.04
2	28 days	4.36

Table 8: Split Tensile Strength of M35 Grade Concrete With different proportions of Robosand

S.No	Sand replacement	Average split tensile strength of the concrete at different ages(N/mm^2)	
		7days	28days
1	50%	3.35	4.58
2	75%	3.16	4.41
3	100%	3.09	4.44

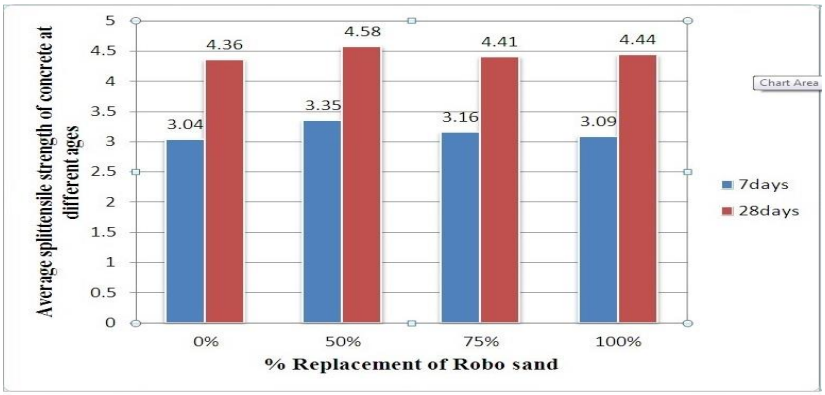


Figure 5: Variation of 7days and 28 Days Split Tensile Strength of M35 Grade

iii). Flexural Strength:

a). Flexural Strength of M25 Grade Concrete With different proportions of Robo sand

Table 9: Flexural Strength of M25 Grade Concrete With different proportions of Robo sand

S.No	Sand replacement	Average Flexural strength of the concrete at the age of 28 days(N/mm^2)
1	0%	6.65
2	50%	8.83
3	75%	7.67
4	100%	7.42

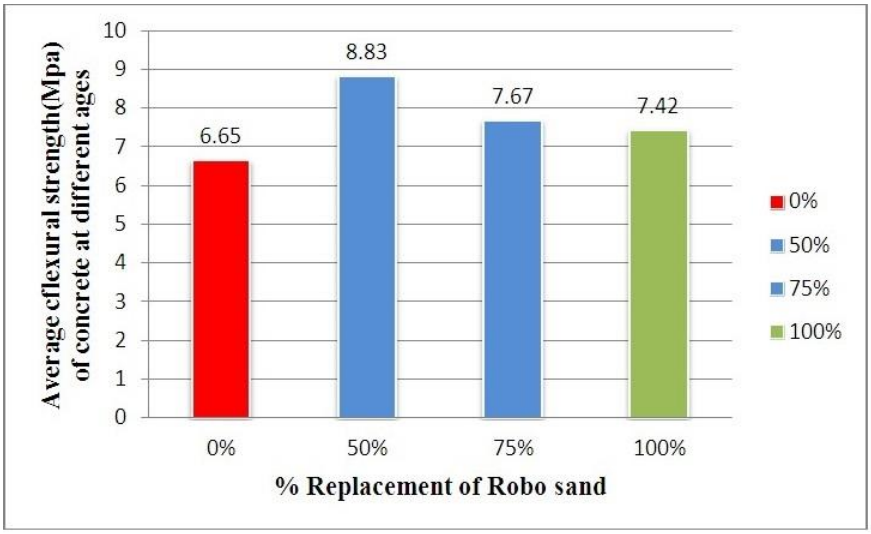


Figure 6: Flexural Strength of M25 Grade Concrete With different proportions of Robo sand

b). Flexural Strength of M35 Grade Concrete With different proportions of Robo sand

Table 10: Flexural Strength of M35 Grade Concrete With different proportions of Robo sand

S.No	**Sand replacement**	**Average Flexural strength of the concrete at the age of 28 days(N/mm^2)**
1	0%	8.67
2	50%	10.58
3	75%	9.5
4	100%	9

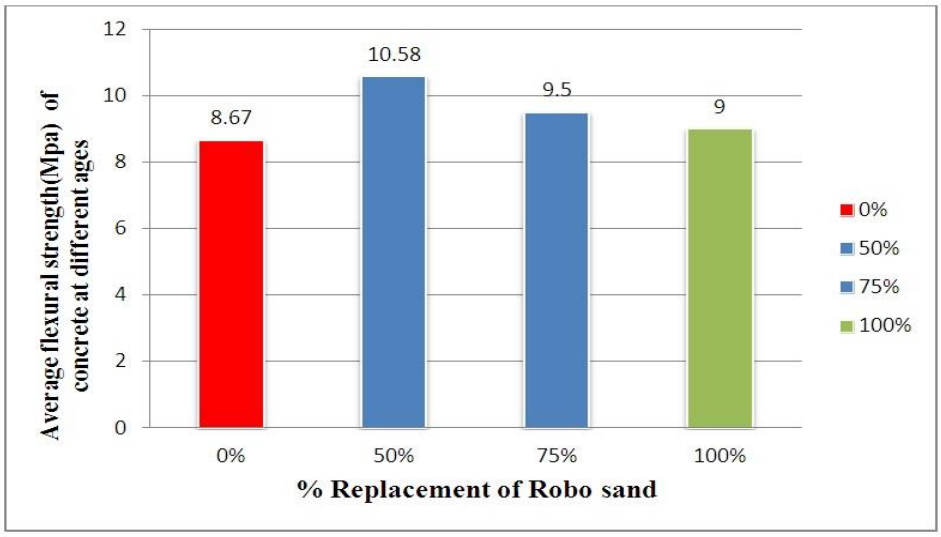


Figure 7: Flexural Strength of M35 Grade Concrete With different proportions of Robo sand

Conclusions

The effect of concrete with partial replacement of River sand with Robo sand and determining the properties of normal strength concrete with water cement ratio of 0.48,0.43 for 7 and 28day's compressive, split tensile and flexural strength of M25,M35 MPa were studied.

The effect of percentage replacement of Robo sand on strength property and workability were evaluated and compared with reference mix of 0% replacement of River sand by Robo sand.

1. The compressive strength of concrete specimens made with 50%replacementof river sand by Robo sand gives higher strength of 12% to 15% and with 100% replacement gives a higher strength of 3% to 4% as compare to reference mix. The split tensile strength of concrete specimens made with 50% replacement of river sand by Robo sand gives higher strength of 7%to 9% and with 100% replacement gives a higher strength of 3%to 4% as compare to reference mix. The flexural strength of concrete specimens made with 50% replacement of river sand by Robo sand gives higher strength of 20%to 22% and with 100% replacement gives a higher strength of 5%to 8% as compare to reference mix. The effect of full replacement of River sand by Robo sand on compressive strength of cement mortar of proportions 1:3 and 1:6 with water cement ratio of 0.45compared with reference mix of 0% replacement of river sand by Robo sand. The compressive strength of cement mortar with 100% replacement of river sand by Robosand gives equal strength as compared reference mix. The percentageof water absorption with river sand is 5% and Robo sand is 12%.Robo sand can be used for plastering. A small area is plastered with cement Robo sand mortar and found that in workmanship there is no difference and is quite suitable for plastering.

6. By replacement of natural sand with Robo sand, the cost of the construction can be reduced to10% per cum.

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